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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/588,668	08/30/2006	Josuke Nakata	F-9186	9961

28107 7590 07/07/2010

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EXAMINER	
GARDNER, SHANNON M	

ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
07/07/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/588,668	NAKATA, JOSUKE	
	Examiner	Art Unit	
	Shannon Gardner	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 April 2010 (Amendment)*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Applicant's amendment of 4/22/2010 does not render the application allowable.

Remarks

Applicant has amended claims 1-17. Currently, claims 1-17 are pending in the application and are considered on their merits below.

Status of Objections and Rejections

The objection to claim 5 is withdrawn in view of Applicant's amendment.

The rejection of claims 6 and 8 under 35 U.S.C. 112, second paragraph as being indefinite is withdrawn in view of Applicant's amendment.

All other rejections from the previous office action are withdrawn in view of Applicant's amendments. New grounds of rejection necessitated by the amendments are set forth below.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata (US 6204545) in view of Alvi (*The Potential for Increasing the Efficiency of Photovoltaic Systems By Using Multiple Cell Concepts*, cited in IDS).

As to claim 1, Nakata is directed to a laminated solar batter (Figure 26) comprising:

- Solar cell modules (200) being incorporated as an integrally laminated structure (by resin 242A) in which the solar cell modules are layered in the laminated structure (see Figure 26),
- At least one of the solar cell modules comprising a group module including nearly spherical solar cell aligned in columns and rows (Figure 26); and
- A serial connection circuit which electrically connects the solar cell modules (column 25, lines 42-45)

Nakata is silent as to an output current of each of the solar modules being approximately equal to one another. But the reference does state that the output voltage and current can be modified as per design requirements (column 25, lines 42-45).

However, it is well known in the solar cell art to match output current of connected solar cells in a solar module such that one solar cell does not limit the overall device output.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to match the output current of each of the solar modules such that they are approximately equal to one another to prevent one cell from limiting the overall device output thereby maximizing the efficiency of the solar cell.

Nakata is also silent as to the solar battery comprising different types of solar cells each having a different sensitivity wavelength and incorporating the solar cells such that the modules are ordered from the shortest center wavelength at the incident side of the battery to the longest being farthest from the incident side.

However, it is known in the solar art to provide different types of solar cell modules each with a respective different sensitivity wavelength (Si, GaAs, GaP; pp 953 and 956) in one tandem device ordered in optical series such that the highest bandgap material first to improve device efficiency (abstract) as taught by Alvi.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide different types of solar cell modules each with a different sensitivity wavelength in the laminated device of Nakata and to order them in optical series with the highest bandgap material closest to the incidental side to improve overall device efficiency as taught by Alvi. The Examiner notes that Nakata also discloses the use of GaP, GaAs and Si materials in his device (column 6, lines 1-5).

4. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata (US 6204545) in view of Alvi (*The Potential for Increasing the Efficiency of Photovoltaic Systems By Using Multiple Cell Concepts*, cited in IDS) as applied to claim 1 above, and further in view of Freundlich et al. (US 6150604).

Regarding claims 2 and 3, Applicant is directed above for a full discussion of Nakata in view of Alvi as applied to claim 1. Modified Nakata teaches three types of nearly spherical solar cells aligned in columns and rows (Nakata; Figure 26) but is silent as to at least one type of the different types of solar cell modules being comprised of at least one planar light receiving modules having a planar common pn junction.

However, Alvi teaches that in order to increase the efficiency of a photovoltaic system it is known to utilize multiple types of solar cells in an effort to capture as much incident light as possible as well as attempting to absorb the majority of light passing through the cell. Further, it is known in the prior art to provide a planar light receiving module having a planar common pn junction (12/16) and a reflective mirrored surface (10) in a solar module to absorb wavelengths of light and reflect back unabsorbed light to increase efficiency as taught by Freundlich et al. (Figure 1).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to supply a planar light receiving module having a planar common pn junction as taught by Freundlich at the bottom of the solar cell of modified Nakata in order to ensure that the light not captured by the spherical solar cells of modified Nakata will then be captured by the bottom solar cell increasing the overall efficiency of the solar device.

5. Claims 4-11, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata (US 6204545) in view of Alvi (*The Potential for Increasing the Efficiency of Photovoltaic Systems By Using Multiple Cell Concepts*, cited in IDS) and Freundlich et al. (US 6150604) as applied to claim 2 above, and further in view of

Nakata (WO 2004/001858, US 2006/00086384 relied upon as English equivalent, references are made to US 2006/00086384).

Regarding claims 4 and 5, Applicant is directed above for a full discussion Nakata in view of Alvi and Freundlich as applied to claim 2. Modified Nakata teaches the solar cells being aligned in plural columns and plural rows (see Nakata; Figure 26) with a planar light receiving module having a planar common pn junction (Freundlich; Figure 1) but is silent as to the plural columns and plural rows in the cell group modules being electrically connected in serial and parallel via plural lead wires extending in a columnar direction or a row direction and led to the outside.

However, it is known in the solar cell art to connect spherical solar cells aligned in plural columns and plural rows via plural lead wires (4a, 4b) extending in a columnar direction as taught by Nakata (WO 2004/001858) as to achieve series or parallel electrical connection (abstract and Figure 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to electrically connect the spherical solar cells of modified Nakata (US 6204545) with plural lead wires extending in a columnar direction to achieve series or parallel electrical connection as taught by Nakata (WO 2004/001858).

Regarding claim 6, the references teach a serial connection circuit for electrically connecting the plural types of solar cell modules (Nakata (WO 2004/001858); abstract) but are silent as to specifically maintaining the output current of each of the cell group modules to be nearly equal to an output current of the planar light receiving module.

However, maintaining the electrical output of the spherical cell modules by controlling the number of spherical cells in a module would have been within purview of one of ordinary skill in the art. It is known in the prior art to achieve a desired electrical output of a solar cell module by altering the number and/or size of the solar cells in the module and therefore by routine experimentation the skilled artisan would have matched the output current of each of the cell group modules to be nearly equal to an output current of the planar light receiving module to prevent shorting of the device and maximize efficiency.

Regarding claim 7, modified Nakata (US 6204545) teaches the cell group modules having plural spherical solar cells aligned in columns and rows (see Nakata (US 6204545); Figure 26).

Modified Nakata teaches changing the number of serial connections and the number of rows of the solar cell array freely to achieve a desired output voltage and output current (column 25, lines 42-45), but does not specifically teach two layers of these spherical solar cells arranged such that the two layers approach one another without overlapping in a plan view.

However, the addition of a substantially similar solar cell module layer made to approach the first without overlapping in a plan view would further increase the efficiency of the solar device by capturing light over a greater surface area and therefore would have been obvious to one of ordinary skill in the art at the time of the invention. Further, the court held that mere duplication of parts has no patentable significance unless a new and unexpected result is produced (see MPEP § 2144.04 B).

Regarding claim 8, Nakata (US 6204545) in view of Alvi and Freundlich teaches the planar light receiving module (Freundlich; 12/16 in Figure 1) being arranged in the lowest layer to be located downside of the plural cell group members (Nakata; Figure 26), and there is provided with a reflective member (Freundlich, 10) capable of reflecting the sunlight downside of the planar light receiving module.

The Examiner notes that the planar light receiving module and mirrored surface of Freundlich is utilized in modified Nakata to capture any light not received by the spherical solar cells thereby increasing the efficiency of the device. Therefore, it would have been obvious to one of ordinary skill in the art to provide this planar module downside of the spherical solar cells.

Regarding claim 9, Freundlich teaches a mirror film on either the backside of the cell or in-situ between active layers (column 3, lines 39-44) but is silent as to the mirror film reflecting a light of sensitivity wavelength bands that can easily be absorbed by solar cell modules above any solar cell module.

However, it is known in the solar cell art to utilize “selective mirrors” to divide the solar spectrum into energy bands that selected cells can respond to as taught by Alvi as a means of improving cell efficiency.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include the selective mirrors of Alvi in the modified device of Nakata (US 6204545) to provide the best cell efficiency possible.

Regarding claim 10, modified Nakata (US 6204545) teaches the plural solar cells (200) being received in a buried state inside synthetic resin material (242A) in the cell group modules (see Nakata (US 6204545); column 25, lines 40-59).

Regarding claim 11, modified Nakata (US 6204545) teaches synthetic resin on top and bottom of solar cell modules (200), see Figure 26 and column 25, lines 40-59) but does not specifically teach a transparent member being fixed at a top of the solar cell module one the one of the solar cell modules at the incidental side of the laminated structure which is adapted to being exposed to sunlight.

However, it is known in the prior art to provide a protective film on at least one surface of the covering material, as taught by Nakata ((WO 2004/001858); paragraph [0022]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a protective glass film on at least one surface of the covering material of the modified device of Nakata (US 6204545) as taught by Nakata (WO 2004/001858).

Regarding claim 16, modified Nakata (US 6204545) teaches plural cell group modules being incorporated above a planar light receiving module. The references do not explicitly teach two types of planar light receiving modules wherein one or more plural cell group modules are incorporated between the two types of planar light receiving modules.

However, it is known in the prior art to provide a protective film on at least one surface of the covering material, as taught by Nakata (WO 2004/001858) (paragraph [0022]) which is capable of receiving light.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a protective glass film on at least one surface of the covering material of the modified device of Nakata (US 6204545) as taught by Nakata (WO 2004/001858) by which the protective glass film receives light from the incident source.

Regarding claim 17, modified Nakata (US 6204545) teaches the laminated solar battery according to claim 1. Nakata (WO 2004/001858) teaches forming plural types of solar cell modules in the shape of a cylinder and then laminated in the shape of a concentric cylinder (Figure 26) to achieve light absorption over a wider incident angle range.

6. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata (US 6204545) in view of Alvi et al. (*The Potential for Increasing the Efficiency of Photovoltaic Systems by Using Multiple Cell Concepts*, cited in IDS) and Freundlich et al. (US 6150604) as applied to claim 3 above, and further in view of Alivisatos et al. (US 20030226498).

Regarding claims 12 and 13, modified Nakata (US 6204545) in view of Freundlich teaches the planar light receiving module being arranged in the lowest position below the multiple cell group modules (The Examiner notes that the planar light receiving module and mirrored surface of Freundlich is utilized in modified Nakata (US

6204545) to capture any light not received by the spherical solar cells thereby increasing the efficiency of the device. Therefore, it would have been obvious to one of ordinary skill in the art to provide this planar module downside of the spherical solar cells), and the three types of cell group modules (Nakata (US 6204545); 200) having the first to third cell group modules laminated sequentially from an incidental side of sunlight.

Alvi teaches the use of 2 or 3 different bandgap material cells ordered in optical series within a single cell module to increase the efficiency of a device (Summary). Alvi further teaches the use of silicon, gallium arsenide and gallium phosphide type materials (pp 953 and 956).

Alivisatos et al. teaches the use of spherical semiconductor nanocrystals in solar cells (abstract and paragraph [0065]) in a binder material (paragraph [0070]). The reference further teaches the use of tandem cells utilizing GaAs, GaP, GaAs, Ge and Si (paragraphs [0003] and [0065]).

One of ordinary skill in the art at the time of the invention would have found it obvious to utilize GaP, GaAs and Si together in a tandem solar cell (as taught by Alivisatos) optically ordered from shortest to longest wavelength absorption (as taught by Alvi) from an incident side wherein the planar light receiving module has a planar common pn junction formed in an InGaAs semiconductor layer which is formed on an n-type InP semiconductor substrate (as taught by Freundlich; Figure 1).

7. Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakata (US 6204545) in view of Alvi et al. (*The Potential for Increasing the*

Efficiency of Photovoltaic Systems by Using Multiple Cell Concepts, cited in IDS) and Freundlich et al. (US 6150604) as applied to claim 3 above, and further in view of and Alivisatos et al. (US 20030226498) and Wegleiter et al. (US 6531405).

Regarding claims 14 and 15, Nakata (US 6204545) in view of Alvi and Freundlich teaches the planar light receiving module being arranged adjacent to the multiple cell group modules. The three types of cell group modules (Nakata (US 6204545); 200) having the first to third cell group modules laminated sequentially from an incidental side of sunlight. Placing the planar light receiving module in a top layer above the plural cell group modules would have been obvious to one of ordinary skill in the art by simple rearrangement of parts (MPEP § 2144.04 C).

Alvi teaches the use of 2 or 3 different bandgap material cells ordered in optical series within a single cell module to increase the efficiency of a device (Summary). Alvi further teaches the use of silicon, gallium arsenide and gallium phosphide type materials (pp 953 and 956).

Alivisatos et al. teaches the use of spherical semiconductor nanocrystals in solar cells (abstract and paragraph [0065]) in a binder material (paragraph [0070]). The reference further teaches the use of tandem cells utilizing GaAs, GaP, GaAs, Ge and Si (paragraphs [0003] and [0065]).

Wegleiter et al. teaches the use of a GaAsP semiconductor layer on a GaP substrate in a planar solar device (column 1, lines 32-36).

One of ordinary skill in the art at the time of the invention would have found it obvious to utilize GaP, GaAs and Si together in a tandem solar cell (as taught by

Alivisatos) optically ordered from shortest to longest wavelength absorption (as taught by Alvi) from an incident side wherein the planar light receiving module has a planar common pn junction formed in an GaAsP semiconductor layer which is formed on an n-type GaP semiconductor substrate (as taught by Wegleiter et al.; column 1, lines 32-36).

Response to Arguments

8. Applicant's arguments with respect to the instant claims as rejected over Simmons (US 5720827) have been considered but are moot in view of the new ground(s) of rejection necessitated by the amendments. New grounds of rejection over Nakata (US 6204545) are set forth in the action above.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shannon Gardner whose telephone number is (571)270-5270. The examiner can normally be reached on Monday to Thursday, 5am-3pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571.272.1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. G./
Examiner, Art Unit 1795

/Alexa D. Neckel/
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